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Kinematics of finite elastoplastic deformations

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Abstract

In this paper we review various approaches to the decomposition of total strains into elastic and nonelastic (plastic) components in the multiplicative representation of the deformation gradient tensor. We briefly describe the kinematics of finite deformations and arbitrary plastic flows. We show that products of principal values of distortion tensors for elastic and plastic deformations define principal values of the distortion tensor for total deformations. We describe two groups of methods for decomposing deformations and their rates into elastic and nonelastic components. The methods of the first group additively decompose specially built tensors defined in a common basis (initial, current, or "intermediate"). The second group implies a certain relation connecting tensors that describe elastic and plastic deformations. We adduce an example of constructing constitutive relations for elastoplastic continuums at large deformations from thermodynamic equations. © 2010 Allerton Press, Inc.

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Keywords

additive representation of deformation tensors, finite elastoplastic deformations, material and spatial tensors, multiplicative decomposition of deformation gradient, principal directions, principal values